lines on page 121 from "The extent" to "0·001," and substitute "The capacity of window glass is but little affected by variations of frequency at ordinary temperatures." The statement as it stands is hardly likely to mislead as it is obviously incorrect; it is unlikely that capacity would increase with frequency.

"On the Distribution of Frequency (Variation and Correlation) of the Barometric Height at diverse Stations." By KARL PEARSON, M.A., F.R.S., University College, London, and Miss ALICE LEE, Bedford College. Received June 15,—Read June 17, 1897.

(Abstract.)

1. Although this paper contains the results of a very large amount of arithmetical work, which has been in progress during the last two or three years, it is not intended in the first place as a contribution to the meteorology of the British Isles. It is especially intended as an *illustration of method*. The authors believe that hitherto no exact theory of variation or of correlation has been applied to meteorological observations, and they have endeavoured to indicate that fruitful results may be obtained from such a theory when applied to one branch at least of meteorology, namely, barometric frequency. They wished to deal with a fairly extended area with an easily accessible material, and this was found in the *Meteorological Observations at Stations of the Second Order* for the British Isles. The "telegraph" stations would have provided better material, but it was far less accessible. The authors have accordingly only dealt with three telegraph stations. The main body of their data was drawn from twenty stations of the second order, four of which are in Ireland, and the remainder distributed round the coast of England, Wales, and Scotland, as indicated on a chart accompanying the memoir.

2. Their first object was to determine the nature of the barometric frequency distribution. By means of tables and plates it is shown that it can be described with a very high degree of accuracy by the use of a generalised frequency curve of the type—

$$y = y_0\left(1+\frac{x}{a}\right)^p e^{-\gamma x},$$

a type which has been fully discussed in a previous memoir on skew variation.

A standard frequency curve for the British Isles having been selected, it is shown that the frequency distribution varies con-

tinuously from this type as we pass from station to station, and appears to be fairly uniform along lines which are termed generalised isobars. If this result should be confirmed, then the positions of these generalised isobars would require a larger series of stations with observations for a longer period of years to determine them accurately.

3. The authors' next object was to discover what constants of the barometric frequency suffice to describe it with the least probable error. A somewhat elaborate investigation was accordingly made into the probable errors of the constants, and four *physical* quantities, the mean, the variation (or standard deviation), the skewness, and the modal frequency were found to be the constants, which described a local barometric frequency with the smallest probable errors.

4. They have next discussed the chief physical features of a barometric frequency distribution.

(*a*) The modal height and the modal frequency are found to possess certain advantages over the mean height and the mean frequency. Various methods are considered for approximately determining the position of the mode. The mean modal height for Great Britain is shown to be very nearly the standard atmosphere of 30″.

(*b*) The variability of the barometric height and the skewness of the distribution are discussed at some length. A formula is given in terms of the skewness for calculating the probability that the barometer at any station will be in excess or defect of the mode or of the mean.

(*c*) A test of the accuracy of the observations for the twenty coast stations is made by attempting to interpolate the frequency constants of London and Cambridge from those of Southampton, Hillington, and St. Leonards. The results are fairly close when tested with the results for London and Cambridge calculated directly from the telegraph station returns.

5. In the second part of the memoir the subject of correlation is dealt with. It is shown that within the limits of the British Isles there is a very high degree of correlation (as high as 0·9824 between Babbacombe and Churchstoke), only sinking to 0·7572 if we take practically the utmost reach of the British Isles. The correlation differs with directions more or less along and more or less perpendicular to the generalised isobars, and it is pointed out that this gradual change with direction and distance, combined with change owing to the interval of time between observations, enables the meteorologist to find systems of stations with almost every variety of correlation coefficient.

The probable height and probable deviation from that height at any given station, based on a knowledge of the heights, contempora-

neous or not, at one, two, three, or more other stations, are considered. It is indicated that with a proper arrangement of times and distribution of stations it must be possible to make the probable deviation zero or nearly zero, and hence to predict with very great accuracy the height at one station from a knowledge of heights at other selected stations. The suggestion is made that this principle might very possibly be applied to closely predict future barometric heights at a given station from antedated observations at other selected stations.

Various theorems are deduced from the general principles of correlation: thus, it is shown that—

(*a*) There is a balance height for every pair of stations, such that when the barometer stands above this height at one station it will usually stand below it at the other, and *vice versâ*.

(*b*) That for a very considerable number of triplets of stations which are positively correlated together, so that a high barometer at one means usually a high barometer at a second, it can still be predicted that if the barometer be steady at one, a rise or fall at the second denotes a fall or rise respectively at the third member of the triplet.

These principles are illustrated from actual observations at stations in the British Isles. The memoir concludes with an appendix, giving an account of a frequency-recording barometer devised by Mr. G. U. Yule.

The writers hope that their paper may draw attention to the importance of rendering the large amount of barometric observations now made, available for the easy calculation of the variation and correlation coefficients. They consider that if a chain of stations round a large continental area could have their correlation for a series of intervals of time worked out, much might be done in the way of very close prediction of barometric changes.

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